HARNESSING SUN RAYS TO A STOVE

Scientist's Feat Foreshadows Further Use of Solar Energy

By Edward W. Coffin

THE man who declared on a recent afternoon that Pennsylvania avenue in Washington was "hot enough to cook an egg" thought he was employing a figure of speech. However, it could be done with the proper apparatus.

On the top of Mount Wilson, in California, where the Smithsonian Institute maintains an observatory, biscuits are cooked, jam is made, and potatoes are boiled, in the new "sun oven," which was successfully operated last summer. For nearly three months three people lived on food cooked in the sun oven.

To hear Dr. Charles G. Abbott, the sun oven builder, tell about it, in careful phrases, each word scientifically correct, is much more entertaining than going to a movie. Dr. Abbott went to Mount Wilson to take observations on the sun. He is the director of the Smithsonian Astrophysical Observatory, and has more sunny information packed inside his brain than any other living man.

He decided to utilize the direct rays of the sun to cook his meals. The machinery was relatively simple.

A "parabolic" mirror, ten feet long and seven feet wide is the base of the apparatus. This sort of a curve for the mirror results in the rays all being reflected to the axis of the parabola, consequently concentrating all the heat along that axis. At the axis, Dr. Abbott put an oil pipe. The rays, concentrated on the pipe, heat the oil.

The oil passes up a pipe, when hot, to an oil reservoir, which in this case was a tank containing about a barrel of oil, in which were immersed the two cooking ovens. Surrounded by the hot oil, of the ordinary variety, such as is used for automobile engines, these ovens rose to a temperature of over 320 degrees, hot enough to boil, bake or stew. It was not possible to fry.

To prevent heat losses in the tube inside the mirror, a glass tube, four inches in diameter was placed around the oil pipe, and the mirror was encased with glass, which kept out the wind and dust. The piping outside the mirror and the oil reservoir were covered with asbestos insulation which prevented any heat escaping. This insulation kept the oil hot for many hours after the sun had gone down, making it possible to cook through the night, or partially through the next day, if it happened to be a cloudy one.

The artistic sense of the scientist would not allow him to cut down a tree which shaded the mirror, so that after 1 o'clock in the afternoon the sun did not shine on the cooking arrangement. But for this it is quite probable that higher temperatures would have been obtained, and a greater amount of heat enabled to be stored.

TO keep the mirror turning so that it constantly faced the sun the works of a $1 alarm clock were utilized. Connected with the movement of an old Seth Thomas clock, a series of weights were so arranged that every five minutes the mirror was slightly rotated, thus holding the rays directly on its surface, although the mirror went out of action at 1 o'clock in the afternoon, on account of the tree foliage, the same mechanism could be used to keep it turning clear around from the time of sun-up until the orb sank below the horizon.

Mrs. Abbott, who accompanied her husband on the observatory trip, did the cooking and was the envy of every visitor to the mountain top. She was always out of doors, with the easily controlled cooking heat just where she wanted it. Cool breezes swept through her open "kitchen." Visitors claimed she had solved the servant problem, and had taken away the disagreeable side in the preparation of a meal.

The sun oven, it was said, would never become a popular proposition for the average home. It is worked best in desert country, where the rays are hot and the rain is seldom. So the dream of the city dweller, of having a sun stove on the apartment roof with hot coils of piping coming down into the corner which serves as a kitchenette, will not come true, at least in this climate. However, it might in other sections of the country.

The cost of the mirror and the mechanism amounted to about $500, which could be cut in half if manufactured on any scale by ordinary commercial methods. But even so, the sun oven will remain the toy of the millionaire, who wants something to show his friends when they come visiting his mountain camp, and who has a coal stove in reserve against those days when the sun takes a vacation.

Power from the sun, to be derived directly from the heat of the rays, has long held the attention of scientists. The idea of cooking is not new, but the successful operation of the device is.

Many years ago sun power plants were operated in Egypt, the power being used to pump water for irrigation systems in the arid sections. The system there used a mirror placed horizontally, and an efficiency of about 4 per cent, on a heat basis was obtained. The efficiency of a modern coal fired locomotive, on a heat basis, is about 12 to 15 per cent.

MODERN science has developed some interesting theories with regard to the sun's direct force. Everything we have today is dependent on the sun, of today and past ages. Coal, oil, rivers, trees, eatables, everything has the sun as the source of primary power. Coal we get as a result of vegetation which grew, eons ago as a result of the sun's heat. Oil is the same. Rivers flow, due to rain, which is water taken up by the sun, and respread over the land, to flow down again to the sea, where the process is repeated. Even water power, therefore, is dependent on the sun, for that part of the solar system keeps the water flowing. Plants stored the sun's rays for ages past, and man of today is reaping the benefit of that storage.

The sun is no longer regarded by scientists as a monster of burning fire, burning in the manner of the fire in a furnace. Such a flame, even with the great size of the sun, would consume all the material quite rapidly and the sun would cool off. Another reason for giving up that old idea is that the temperature of the sun has been determined, by several experimenters, who agree in placing it at about 6,000 degrees Centigrade, or about 10,800 degrees Fahrenheit. This temperature is far too high to permit the formation of most chemical compounds. In order to produce heat, it is necessary to form these compounds. So such a high temperature, which decomposes nearly all compounds into their elements, would prevent their reuniting and consequently prevent the production of heat, which comes from that reuniting.

Scientists are not certain by any means just how the heat is produced. One theory is of radioactivity. Another is that the energy to keep up the radiation and the supply of heat could be supplied by a microscopic contraction of the sun's volume. This theory is not a complete success, because it implies that the age of the sun is about 17,000,000 years. Geology indicates that the earth itself is older than that, and as the earth cannot well be older than the sun, as the center of the universe, it was concluded that the sun was older than 17,000,000 years, which put a nail, but not a spike complete, in the contraction theory.

There is also doubt about the structure of the sun. But there is general agreement that the sun's specific gravity is about one quarter that of the earth, and the conclusion is that the sun can, therefore, go on contracting indefinitely, thereby getting hotter instead of cooler.

The diameter of the sun is 863,000 miles or about 100 times that of the earth. And curiously, a weight of one pound, on the grocer's scales here on earth would weigh twenty-seven and one-half pounds on the surface of the sun. The big red disk which the sun presents to the human eye has an area of 585,750,000,000 square miles, and each square foot of that area emits an amount of energy equivalent to 12,000 horsepower. The radiant energy which arrives at the earth is much smaller than that, of course, due to the losses in transmission, but it is a tremendous figure—amounting to 7,500 horsepower per acre at the outer surface of the earth's atmosphere. Of this amount about 70 per cent is transmitted to the land surface of the earth so that on a clear day, at noon, we would have about 5,000 horsepower of energy per acre, coming from the sun. There would be less, of course, in the morning and evening, due

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OLD SOL STOKES THIS OVEN

THIS oven truly produces sun-cooked bread, and at the top of a mountain. The tank contains about one barrel of cylinder oil. The heated oil rises through one pipe and flows down through another, conveying heat to the food containers from a cylinder upon which rays concentrated by a parabolic reflector, play with great caloric effect.